PATENT APPLICATION

RESPONSE UNDER 37 CFR §1.116
EXPEDITED PROCEDURE
TECHNOLOGY CENTER ART UNIT 1745

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Yoshiaki HAMANO et al. Group Art Unit: 1745

Application No.: 10/713,114 Examiner: C. LEE

Filed: November 17, 2003 Docket No.: 117785

For: POSITIVE ELECTRODE MATERIAL FOR LITHIUM SECONDARY BATTERY, METHOD FOR PRODUCING THE SAME, AND LITHIUM SECONDARY BATTERY

REQUEST FOR RECONSIDERATION AFTER FINAL REJECTION

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In reply to the July 6, 2007 Office Action, reconsideration of the rejections is respectfully requested in light of the following remarks.

Claims 1-5 and 14 are pending in this application. By the Office Action, claims 6-13 are withdrawn from consideration and claims 1-5 and 14 are rejected under 35 U.S.C. § 103(a). Reconsideration of the application based upon the following remarks is respectfully requested.

I. Rejections Under 35 U.S.C. § 103(a)

Claims 1 and 14 are rejected under 35 U.S.C. § 103(a) over Lampe-Onnerud *et al.* ("Lampe-Onnerud"). Claims 2-5 are rejected under 35 U.S.C. § 103(a) over Lampe-Onnerud

in view of Lee *et al.* ("Lee"). Because the rejections are related, they are addressed together. Applicants respectfully traverse the rejections.

Independent claim 1 of the present application specifies a positive electrode material for a lithium secondary battery that is a composite oxide powder having a total composition represented by $Li_aNi_bCo_cBa_dAl_eO_x$, where a/(b+c): 1.0 to 1.2, b/(b+c): 0.5 to 0.95, c/(b+c): 0.05 to 0.5, d/(b+c): 0.0005 to 0.01, e/(b+c): 0.01 to 0.1, b+c = 1 and x > 0. Each of the cited references fails to teach or suggest a positive electrode material for a lithium secondary battery according to the claimed composition, and thus fails to have rendered obvious the claimed invention.

Lampe-Onnerud describes a lithium battery cathode material having a core and a coating on the core. Lampe-Onnerud describes a core material having an empirical formula $Li_xM'_zNi_{1-y}M''_yO_2$ where "x" is equal to or greater than about 0.1 and equal to or less than about 1.3; "y" is greater than about 0.0 and equal to or less than about 0.5; and "z" is greater than about 0.0 and equal to or less than about 0.2 (Lampe-Onnerud, Abstract). In this formula, M' is at least one member of the group consisting of sodium, potassium, nickel, calcium, magnesium and strontium; and M" is at least one member of the group consisting of cobalt, iron, manganese, chromium, vanadium, titanium, magnesium, silicon, boron, aluminum and gallium (Lampe-Onnerud, Abstract).

Lampe-Onnerud also describes a coating on the core of a lithium battery having a composition represented by the empirical formula $Li_{x1}A_{x2}Ni_{1-y1-z1}Co_{y1}B_{z1}O_a$ where x1 is greater than about 0.1 and equal to or less than about 1.3; x2, y1 and z1 are each greater than about 0.0 and equal to or less than about 0.2; a is greater than 1.5 and less than about 2.1 (Lampe-Onnerud, para. 0047). In Lampe-Onnerud's formula, A is at least one element selected from the group consisting of barium, magnesium, calcium, and strontium; and B is at least one element selected from the group consisting of boron, aluminum, gallium,

manganese, titanium, vanadium and zirconium (Lampe-Onnerud, para. 0047). Lampe-Onnerud then describes two preferred embodiments of the invention. The first preferred embodiment is when A is magnesium and B is aluminum (Lampe-Onnerud, para. 0047). The second preferred embodiment is when A is magnesium and B is manganese (Lampe-Onnerud, para. 0047). Lampe-Onnerud also states that a characteristic of the composition of the invention is that the ratio of cobalt to nickel increases, as a gradient, from the core to the outer surface of the coating (Lampe-Onnerud, para. 0042).

The claimed invention specifies a positive electrode material for a lithium secondary battery that is a composite oxide powder having a total composition represented by the claimed formula. Lampe-Onnerud describes an invention having a core and a core coating, each containing a different composition, whereas claim 1 of the present application specifies a total composition. Therefore, the claimed invention does not have a cobalt to nickel ratio that increases, as a gradient, from the core to the outer surface.

Accordingly, Lampe-Onnerud does not describe the use of a positive electrode material for a lithium secondary battery that is a composite oxide powder having a total composition represented by the given formula, as claimed.

The composition and ranges described in Lampe-Onnerud are also too broad to support a prima facie case of obviousness. MPEP 2144.05 states "if the reference's disclosed range is so broad as to encompass a very large number of possible distinct compositions, this might present a situation analogous to the obviousness of a species when the prior art broadly discloses a genus." MPEP 2144.08 cites to *In re Baird*, 16 F.3d 380, 382 29 USPQ2d 1550, 1552 (Fed. Cir. 1994), which states "[t]he fact that a claimed compound may be encompassed by a disclosed generic formula does not by itself render that compound obvious." Lampe-Onnerud's formula provides an extremely large number of possible distinct compositions, and

thus it would not have been obvious for a person skilled in the art to select Applicants' specific claimed compositions from Lampe-Onnerud's broad disclosure.

Comparing the instant claim to the composition of Lampe-Onnerud, Applicants specifically claim barium as element "A" and aluminum as element "B". Applicants also further limit the claimed compositions to very narrow ranges of barium and aluminum. Applicants' compositions have a barium range of about 0.0005 to about 0.01 and an aluminum range of about 0.01 to about 0.1 where each range is given as the value against the sum of the mole composition ratio of nickel and cobalt, as claimed. If Lampe-Onnerud's formula is converted to the sum of the mole composition ratio of nickel and cobalt, then the range of composition for both elements "A" and "B" become 0.0 to about 0.25.[1]

Thus, Lampe-Onnerud specifies at least one of four specific elements for element "A" and at least one of seven specific elements for element "B." Taking only one element for each of "A" and "B" yields twenty-eight different element combinations. The number of possible element combinations increases exponentially where more than one element is selected for elements "A" and/or "B." Furthermore, the content ranges for each element spans a range of 0 to 0.25. In contrast to these broad and numerous possibilities, instant claim 1 is limited to the selection of barium and aluminum as Lampe-Onnerud's elements "A" and "B." Thus, from among Lampe-Onnerud's numerous possible combinations, claim 1 is directed to a single combination that is nowhere specifically taught nor suggested in the reference. Still further, the claimed combination is more limited in its content ranges to provide a barium content of about 0.0005 to about 0.01 and an aluminum content of about 0.01 to about 0.1. As such, even the claimed content ranges correspond to only 3.8% of the range for Lampe-

[1] Formula used: $A = x2/(1-z1)$, $B = z1/(1-z1)$, when $x2, z1 = 0$ to 0.2 then A, B = 0 to 0.25.

Onnerud's element "A" and 36% of the range for Lampe-Onnerud's element "B." The instant claim thus covers only a small fraction of the broad disclosure of Lampe-Onnerud.

Applicants selectively claim these composition ranges because they are the only barium and aluminum ranges for which the purpose of the present invention can be achieved. For example, Comparative Example 3 of Table 2 of the present specification shows barium equal to 0.2. This composition is encompassed by Lampe-Onnerud's ranges but is outside Applicants' claimed range. Even though only barium is outside the claimed range, appropriate thermal stability cannot be obtained and the discharge capacity is also degraded. Comparative Example 5 of Table 2 contains only aluminum. In the absence of barium, the cycle performance, the safety performance and the discharge capacity all proved inferior to the claimed invention. Lampe-Onnerud nowhere teaches these specific effects that are provided by the claimed invention, and nowhere teaches or suggests that the elements and content amounts could or should be specifically selected to provide these beneficial results.

Accordingly, Lampe-Onnerud does not teach or suggest a positive electrode material for a lithium secondary battery according to the specifically selected compositions, as claimed.

Lee does not overcome the differences of Lampe-Onnerud. Lee describes a modified lithium cobalt oxide that is useful as a cathode of a lithium ion battery for increasing a charge voltage to 4.4 V (Lee, Abstract). The modified lithium cobalt oxide includes a particle having the formula $LiCoO_2$ and an oxide of ZrO_2, TiO_2, B_2O_3, Al_2O_3, or Ga_2O_3 deposited on the surface of the particle (Lee, Abstract). In comparison, the claimed invention discloses a Li-Ni-Co complex oxide represented by the claimed formula.

In a positive active material consisting of a core and a coating, the composition of the core and that of the coating are not independent but are related to each other. The discharge and charge of a lithium secondary battery is caused by ionic migration, as Li ions migrate

from a lithium compound, the structure of the Li ions need to be configured to allow easy migration of the Li ions. Therefore, the core determines many of the important cathode properties such as capacity performance, rate performance, and high temperature storage stability. The claimed invention specifies a Li-Ni-Co complex oxide, whereas, Lee discloses a modified Li-Co oxide. Lee does not disclose the use of nickel in the core composition, which improves the capacity performance of the claimed invention.

Thus, Lee does not teach or suggest the use of a Li-Ni-Co complex oxide as a positive electrode material for a lithium secondary battery, as claimed.

Claims 2-5 and 14 all variously depend from claim 1. Because Lampe-Onnerud and Lee fail to teach or suggest the features recited in independent claim 1, dependent claims 2-5 are patentable for at least the reasons that claim 1 is patentable, as well as for the additional features they recite.

Accordingly, any combination of the cited references fails to teach or suggest a positive electrode material for a lithium secondary battery according to the specifically selected compositions, as claimed. The references thus would not have rendered obvious the claimed invention. Accordingly, reconsideration and withdrawal of the rejections are respectfully requested.

III. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of this application are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

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JAO:JLR/tjx

Attachment:
Petition for Extension of Time

Date: December 6, 2007

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